MEIOTIC DISORDERS INDUCED BY NADOLOL IN ALLIUM CEPA L.

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Several investigators studied the effect of drugs on either somatic or germ cells among them. Shahab et al. (1983, 1985), Shehab and Abo El-Kheir (1984), Reddy and Subramanyam (1985) and El-Bayoumi et al. (1985).

The present investigation was undertaken to elucidate the effects of Nadolol drug on meiosis of Allium cepa L. pollen mother cells (P.M.C.s).

Nadolol is used in the treatment of hypertension and angina pectoris. In hypertension the initial starting dose is usually 40 to 80 µg once daily. The usual maintainance dose is 80 to 320 µg once daily.

MATERIAL AND METHODS

Allium cepa (Var. Giza 5) flower buds were treated for 3 and 6 hours with the different concentrations of the drug (50. 100 µg/ml and 1 mg/ml) using a piece of cotton soaked with the drug solution. The treated flower buds were collected 24 and 48 hours after treatment (recovery test) at random from 20 plants for each treatment. Tap water was used for control in the same manner. Flower buds were fixed in Carnoy's fluid and examined using aceto carmine smear method.

RESULTS AND DISCUSSION

Tables 1 and 2 show that the drug induced a high percentage of aberrations in all treatments of the drug. This percentage increased with the increase of concentration in all treatments of 24 & 48 hours recovery, except 3 hrs treatment with 1 mg/ml after 24 hrs. recovery.

The effect of Nadolol drug was permanent, since the percentage of aberration increased with lapse of time of recovery. After 24 & 48 hrs. recovery the first division has the highest percentage of anomalis except 6 hrs. treatment with 100 µg after 24 hrs. recovery (Table 1) and 3 & 6 hrs. treatment with 50 µg/ml after 48 hrs. recovery (Table 2). The decrease in aberration percentage with the progress of meiotic stages from the first to the second division may indicate the loss (elimination) of aberrant cells (gametes) from the population, and not the recovery of these cells from aberration events Ashour (1988).

No trend was observed between the percentage of anomalis and time of treatment in the second division.

Tables 3 and 4 represent the percentage of the different types of abnormalities induced as a result of treatment of Allium cepa flower buds with the different concentrations of Nadolol drug.

Stickiness was the most prominent abnormality in all treatments of the drug. The highest percentage of stickiness was observed in diakinesis and MI and it gradually decreased in the later meiotic division. Fig.1 shows sticky MI with swallen and grouping of bivalents. The sticky clumped chromosomes when try to separate they form sticky bridges (Fig. 2).

A less dominant abnormality was the disturbed. Fig. 3 shows disturbed anaphase I and Fig. 4 shows the disturbance in one pole only of anaphase I.

Nadolol induced clastogenic effect such as laggards (Fig. 5) and fragment and bridges Fig. 6.

In addition to above mentioned abnormalities despiralization assynchronization, diagonal and univalent were observed in low percentage in some of the treatments.

Micro and multinucleate cells were observed which are a result of either spindle disturbance or lagging chromosomes. The same types of abnormality have been met with and discussed by a number of authors, among them Kunzel and Mirslaw 1966, Vig 1969 and Bezo et al., 1980.

SUMMARY

In this investigation the effect of nadolol on Allium cepa PMCs was studied. The drug gave high percentage of abnormalities. The percentage of abnormalities was higher in the 1st division. Metaphases have the highest percentage of aberrations.

Different types of abnormalities were met with stickiness, disturbed metaphases and ana-telophases, lagging chromosomes, bridges, fragments and despiralization. Micro and multinucleate cells were also recorded.

REFERENCES

Ashour, F.M. 1988: A study of some aspects of chemically - induced chromosomal aberrations in plant cells. Ph.D. Thesis. Dept. of Botany, Univ. of Alexandria.

Bezo, M., Horaska, S. Caghan, L. 1980: The cytogenetic effect of Derosal Bowp and Topsin M. 79 on Vicia faba L. Polnohospodarsto: 26, (6). 534-538.

El-Bayoumi, A.A. Habib and A.S. Haliem 1985: Mitotic abnormalities induced by the drug voltaren on meristematic plant cells Abstracts of the IV international conference of environmental mutagens, P. 177.

Kunzel, G. and M. Mirslaw 1966: Various reaction of chromosomes of shoot and root meristems from barely to mutagenic treatment. Kulturpflanze 14:83-96.

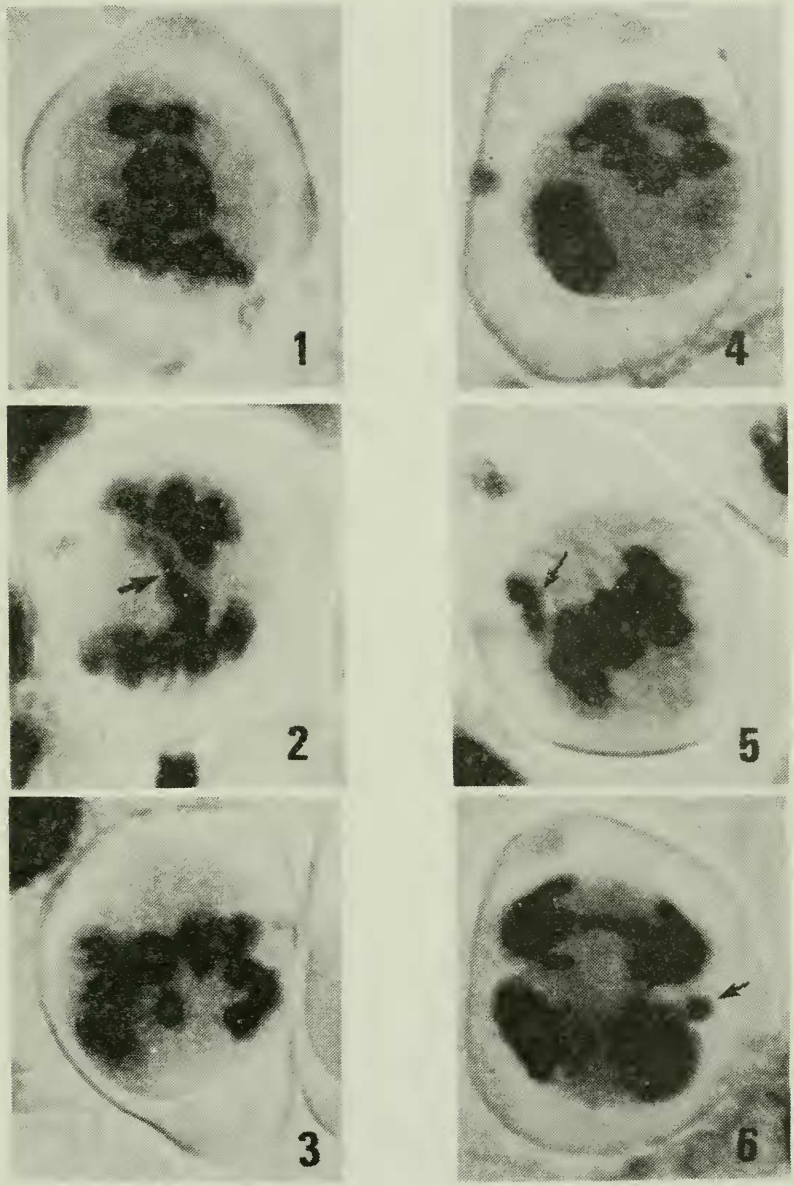
Reddy, G.A. and Subramanyam, S. 1984: Cytological effects of metamizole on mitotic cells of Allium cepa. Egypt. J. Genet. Cytol. 13:189-206.

Shehab, A.S., Zakia M. Adam and A.I. El-Sedawy 1983:Meiotic disorders induced by water extracts of Datura innoxia and Hyoscyamus muticus and their pure active ingredients in Vicia PMCs. Annals Agric. Sci., Fac. Agric., Ain-Shams Univ., Cairo, Egypt. Vol. 28 (3), PP. 1593-1603.

Shehab, A.S. and Zakia, A., Abo-El-Khier. 1984: Effect of Phenothiazine tranquilizing drugs on meiosis.
Annals Agric. Sci., Fac. Agric., Ain-Shams Univ., Cairo, Egypt. 29 (2), 891-902.

Shehab, S. and Zakia, A. Abo-El-Khier (1985): Effects of Antihistaminic Drugs on Meiosis of Vicia faba and Allium cepa. Cytologia. 50:789-795.

Vig, B.K. 1969. The origin and consequences of subchromatid aberrations in Gasteria erenstii ruschii. Canad J. Genet. Cytol. 11: 325-332.



ILLUSTRATIONS: Fig. 1: Sticky MI (50 μg/ml) for 3 hr nadolol after 24 hr recovery. **Fig. 2:** AI with bridge (50 μg/ml) for 6 hr nadolol after 24 hr recovery. **Fig. 3:** Disturbed AI (1 mg/ml) for 6 hr nadolol after 48 hr recovery. **Fig. 4:** Disturbed AI at one pole only (100 μg/ml) for 3 hr nadolol after 24 hr recovery. **Fig. 5:** Lagging chromosome at MI (1 mg/ml) for 3 hr nadolol after 48 hr recovery. **Fig. 6:** AII with bridge and fragment (50 μg/ml) for 3 hr nadolol after 48 hr

M = Metaphase; A = Anaphase

Table (1): Percentage of total abnormalities and abnormalities in each phase of meiosis in Allium cepa L. treated with the drug after 24 hours recovery.

Experimental agent		No. of Counted cells	No. of abn. cells	% of total abn.	1st division				2nd division			
					% of abn. metaphase	% of abn. anaphase.	% of abn. telophase	Total % of abn.	% of abn. metaphase	% of abn. anaphase	% of abn. telophase	Total % of abn.
Control		4787	114	2.38	5.36	2.27	0.7	4.28	0.43	1.6	0.63	1.12
3 hours	50 µg/ml.	3581	709	19.80	29.4	53.54	20.00	25.87	19.17	21.26	8.15	15.46
	100 µg/ml.	2356	729	30.94	35.16	60.9	37.92	37.52	75.76	34.85	10.07	22.90
	1 mg/ml.	4182	846	20.23	27.34	75.00	16.59	23.99	46.25	52.14	5.75	18.17
4 hours	50 µg/ml.	3431	630	18.36	36.08	37.70	9.78	22.96	27.67	39.46	5.43	14.76
	100 µg/ml.	2464	532	21.59	20.71	29.48	11.71	19.04	29.36	29.75	11.52	23.59
	1 mg/ml.	3086	767	24.85	33.68	64.64	12.04	51.9	51.9	41.15	1.32	15.42

No = Number
Abn = Abnormal

Table (2): Percentage of total abormalities and abnormalities in each phase of meiosis in Allium cepa L. treated with the drug after 48 hours recovery.

Experimental agent		No. of counted cells	No. of abn. cells	% of total abn.	1 st division				2nd division			
					% of abn. metaphase	% of abn. anaphase	% of abn. telophase	Total % of abn.	% of abn. metaphase	% of abn. anaphase	% of abn. telophase	Total % of abn.
	Control	4375	153	3.50	7.15	2.19	1.10	3.81	3.90	3.45	2.03	3.04
3 hours	50 µg/ml.	1549	358	23.11	34.15	30.56	9.14	26.54	32.27	36.80	4.25	54.19
3 hours	100 µg/ml.	1872	621	33.17	45.83	35.71	36.81	38.78	38.84	34.71	14.66	28.50
3 hours	1 mg/ml.	2011	725	36.05	47.49	39.76	33.82	41.57	44.29	40.87	21.44	31.30
6 hours	50 µg/ml.	1908	788	41.30	41.82	48.65	35.02	39.38	50.58	47.81	25.27	42.52
6 hours	100 µg/ml.	1119	483	43.16	51.72	51.02	45.46	48.89	53.82	59.13	16.85	39.31
6 hours	1 mg/ml.	1387	620	44.70	59.54	57.14	42.98	55.77	51.42	49.01	21.16	37.14

Table (3): Percentage of each type of abnormalities in Allium cepa L.P.M.Cs. treated with 50,100 µg/ml and 1 mg/ml Nadolol after 24 hours recovery.

Experimental agents		Stickiness	Disturbins	lagging	bridge	fragment	diagonal	univalent	micronuclei	multinucleate	assynchro-nization	despira-lisation
Control		78.95	7.01	10.53	0.88	-	-	-	0.88	1.75	-	-
3 hours	50 µg/ml.	39.35	12.83	9.03	11.14	5.78	1.41	0.56	13.68	5.08	0.42	0.71
	100 µg/ml.	44.72	3.98	6.31	8.92	10.70	3.57	-	20.85	0.69	0.27	-
	1 mg/ml.	50.24	14.54	8.87	3.31	3.43	0.70	0.95	9.10	8.51	0.35	-
6 hours	50 µg/ml.	53.81	13.49	8.41	7.46	1.75	1.43	-	8.89	4.26	0.48	-
	100 µg/ml.	46.8	11.28	7.14	4.51	9.02	4.70	-	15.04	1.13	0.19	0.19
	1 mg/ml.	54.63	12.65	6.00	15.25	4.69	1.57	-	3.13	0.65	0.13	1.30

Table (4): Percentage of each type of abnormalities of Allium cepa L.P.M.Cs. treated with 50, 100 µg/ml, 1 mg/ml Nadolol after 48 hours recovery during the 3 and 6 hours exposure.

Experimental agent		stickiness	disturbins	lagging	bridge	fragment	diagonal	univalent	micronuclei	multinucleate	assynchro-nization	despira-lisation
Control		71.90	10.46	9.15	2.61	-	-	-	1.96	3.92	-	-
3 hours	50 µg/ml.	49.44	12.29	5.87	10.89	10.62	2.51	1.68	2.79	3.35	0.56	-
	100 µg/ml.	42.51	10.31	8.21	13.21	4.35	0.16	1.77	18.68	0.64	0.16	-
	1 mg/ml.	37.93	9.38	11.17	17.66	4.41	1.38	-	14.90	2.35	0.14	0.68
6 hours	50 µg/ml.	37.18	12.06	9.52	10.15	6.22	1.78	0.51	10.03	12.18	0.25	0.13
	100 µg/ml.	38.92	7.87	4.97	5.38	11.39	2.28	1.45	19.67	7.45	0.62	-
	1 mg/ml.	50.32	9.52	5.97	5.00	6.29	0.97	1.13	0.48	20.00	-	0.32